

NEW PERSPECTIVES



MSOffice Excel - Part 3

Calculating Data with Formulas and Functions



Objectives

- Make a workbook user friendly
 - Translate an equation into an Excel formula
 - Understand function syntax
 - Enter formulas and functions with the Quick Analysis tool
 - Enter functions with the Insert Function dialog box
 - Change cell references between relative and absolute
-

Objectives

- Use the AutoFill tool to enter formulas and data and complete a series
- Display the current date with the TODAY function
- Find the next weekday with the WORKDAY function
- Use the COUNT and COUNTA functions

Objectives

- Use an IF function to return a value based on a condition
- Perform an exact match lookup with the VLOOKUP function
- Perform what-if analysis using trial and error and Goal Seek

Visual Overview: Functions

Functions are organized by category in the Function Library group. Select a function to open the Function Arguments dialog box.

The Insert Function button opens the Insert Function dialog box from which you can select a function.

The SUM function adds the values in the range.

The AVERAGE function calculates the average value of the range.

The MEDIAN function determines the middle value in the range.

The MAX function displays the maximum value in the range.

The MIN function displays the minimum value in the range.

Exercise Statistics	Jogging	Calisthenics	Strength
SUM	278	245	347
AVERAGE	16.4	14.4	20.4
MEDIAN	15.0	15.0	20.0
MAX	22	20	30
MIN	10	8	12

Jogging (min.)

=SUM(I23:I45)

=AVERAGE(I23:I45)

=MEDIAN(I23:I45)

=MAX(I23:I45)

=MIN(I23:I45)

© 2014 Cengage Learning

Cell References and Excel Functions

The Function Arguments dialog box displays the arguments used by each function. **Arguments** are the numbers, text, or cell references used by the function to return a value.

Required arguments are needed for the function to return a value. These are displayed in bold.

Optional arguments are not required for the function to return a value.

A **relative reference** is a cell reference that is interpreted in relation to the location of the cell containing the formula. For example, M23 is a relative reference to cell M23.

An **absolute reference** is a cell reference that remains fixed when the cell formula is copied to a new location. It includes a \$ in front of the column letter and row number. For example, \$M\$23 is the absolute reference to cell M23.

	Strength	Total	Calories	Running Total Of
10	15			376.1
8	12			698.5
18	15			1182.1
15	18			1182.1
10	15			1665.7
				2095.6
				2095.6
15	20	50	537.3	2632.9
13	22	50	537.3	3170.2
15	25	60	644.8	3815.0

Making Workbooks User-Friendly

Creating an explanatory worksheet

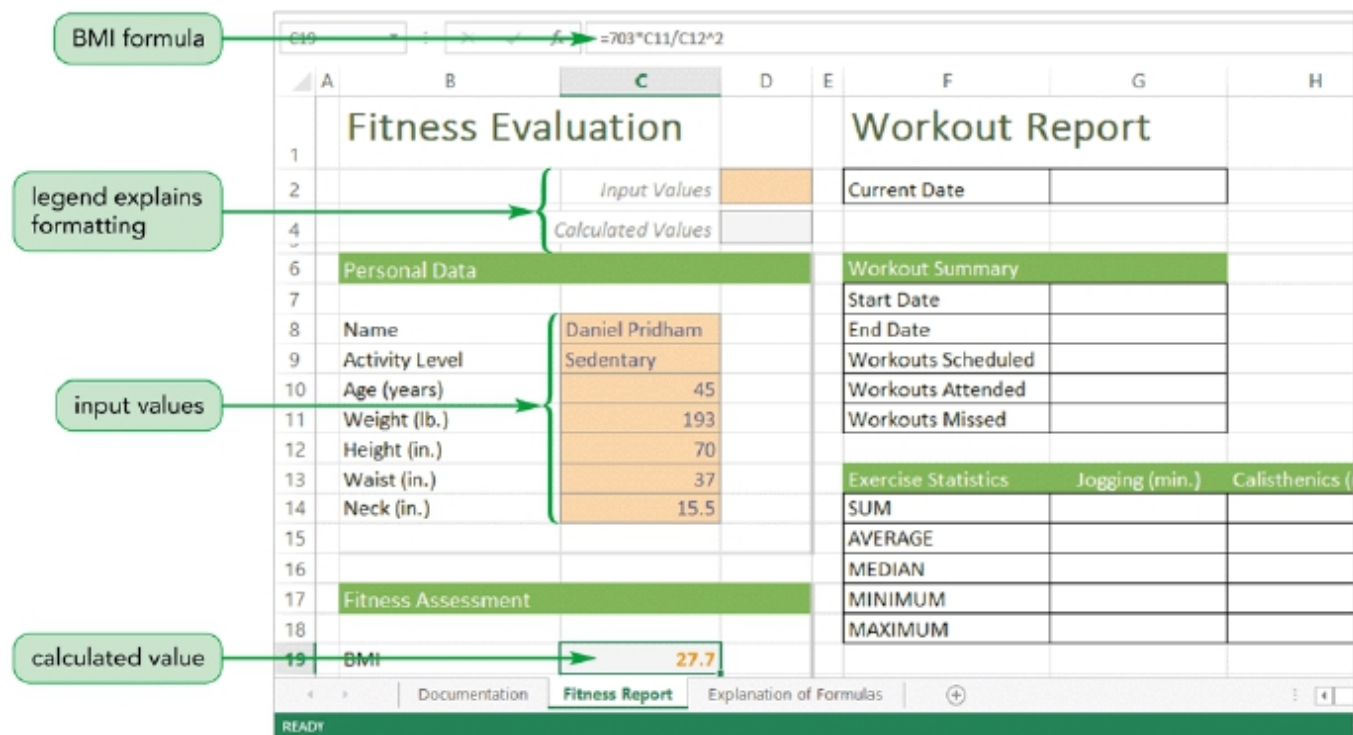
- Many users may use the workbook so it is important they understand the contents.
- A worksheet can be added explaining concepts including:
 - Industry jargon (Industry-specific terms, or technical terms)
 - What is being calculated and why
 - Formulas used in calculations

Making Workbooks User-Friendly

Using formatting and styles to differentiate cell contents

Figure 3-3

Input and calculated values formatted with cell styles



Working with Functions

- Quick way to calculate summary data
- Every function follows a set of rules (**syntax**) that specifies how the function should be written

- General syntax of all Excel functions

FUNCTION(argument1, argument2, ...)

- Square brackets indicate optional arguments

FUNCTION(argument1, [argument2=value2, ...])

Excel Function Categories

Figure 3-4 Excel function categories

Category	Description
Cube	Retrieve data from multidimensional databases involving online analytical processing (OLAP)
Database	Retrieve and analyze data stored in databases
Date & Time	Analyze or create date and time values and time intervals
Engineering	Analyze engineering problems
Financial	Analyze information for business and finance
Information	Return information about the format, location, or contents of worksheet cells
Logical	Return logical (true-false) values
Lookup & Reference	Look up and return data matching a set of specified conditions from a range
Math & Trig	Perform math and trigonometry calculations
Statistical	Provide statistical analyses of data sets
Text	Return text values or evaluate text
Web	Provide information on web-based connections

© 2014 Cengage Learning

Excel Functions

Figure 3-5

Common Math, Trig, and Statistical functions

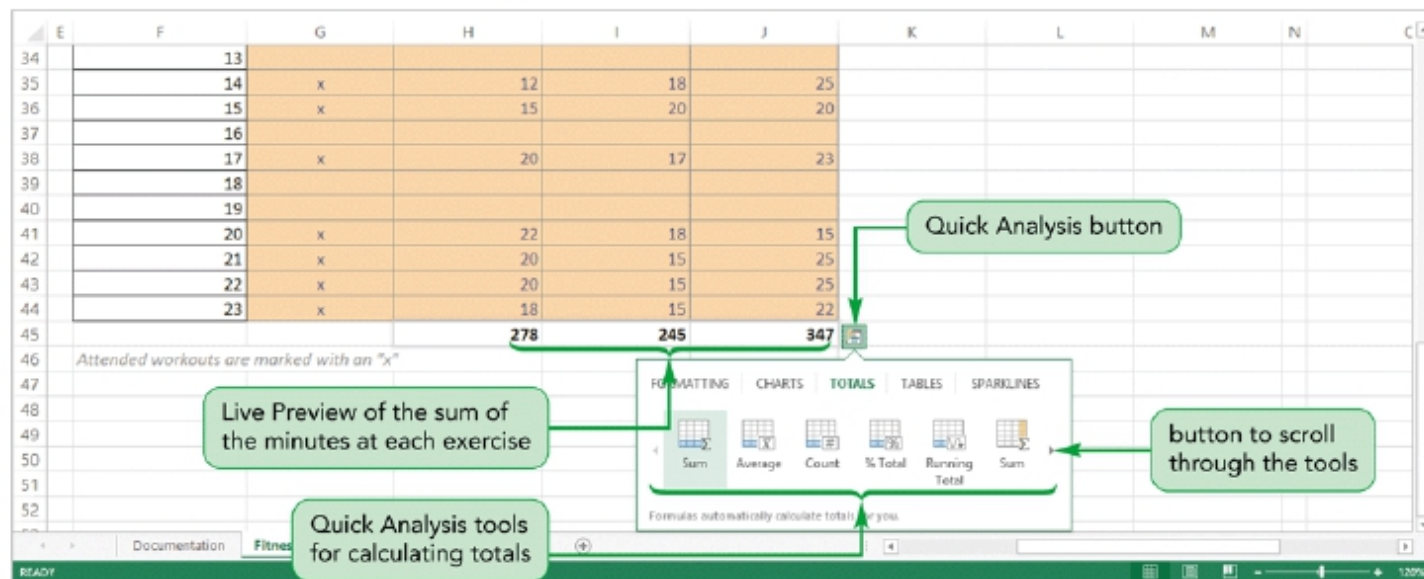
Function	Category	Description
AVERAGE(<i>number1</i> [, <i>number2</i> , <i>number3</i> , ...])	Statistical	Calculates the average of a collection of numbers, where <i>number1</i> , <i>number2</i> , and so forth are numbers or cell references; only <i>number1</i> is required
COUNT(<i>value1</i> [, <i>value2</i> , <i>value3</i> , ...])	Statistical	Counts how many cells in a range contain numbers, where <i>value1</i> , <i>value2</i> , and so forth are text, numbers, or cell references; only <i>value1</i> is required
COUNTA(<i>value1</i> [, <i>value2</i> , <i>value3</i> , ...])	Statistical	Counts how many cells are not empty in ranges <i>value1</i> , <i>value2</i> , and so forth, or how many numbers are listed within <i>value1</i> , <i>value2</i> , etc.
INT(<i>number</i>)	Math & Trig	Displays the integer portion of <i>number</i>
MAX(<i>number1</i> [, <i>number2</i> , <i>number3</i> , ...])	Statistical	Calculates the maximum value of a collection of numbers, where <i>number1</i> , <i>number2</i> , and so forth are either numbers or cell references
MEDIAN(<i>number1</i> [, <i>number2</i> , <i>number3</i> , ...])	Statistical	Calculates the median, or middle, value of a collection of numbers, where <i>number1</i> , <i>number2</i> , and so forth are either numbers or cell references
MIN(<i>number1</i> [, <i>number2</i> , <i>number3</i> , ...])	Statistical	Calculates the minimum value of a collection of numbers, where <i>number1</i> , <i>number2</i> , and so forth are either numbers or cell references
RAND()	Math & Trig	Returns a random number between 0 and 1
ROUND(<i>number</i> , <i>num_digits</i>)	Math & Trig	Rounds <i>number</i> to the number of digits specified by <i>num_digits</i>
SUM(<i>number1</i> [, <i>number2</i> , <i>number3</i> , ...])	Math & Trig	Adds a collection of numbers, where <i>number1</i> , <i>number2</i> , and so forth are either numbers or cell references

© 2014 Cengage Learning

Entering Functions with the Quick Analysis Tool

- The Quick Analysis tool can generate columns and rows of summary statistics that can be used for analyzing data.

Figure 3-6 Quick Analysis tool to calculate totals



Working with Functions

- Advantage of using cell references:
 - Values used in the function are visible to users and can be easily edited as needed
- Functions can also be placed inside another function, or **nested** (must include all parentheses)

Choosing the Right Summary Function

- AVERAGE function
 - To average sample data
 - Susceptible to extremely large or small values
- MEDIAN function
 - When data includes a few extremely large or extremely small values that have potential to skew results
- MODE function
 - To calculate the most common value in the data

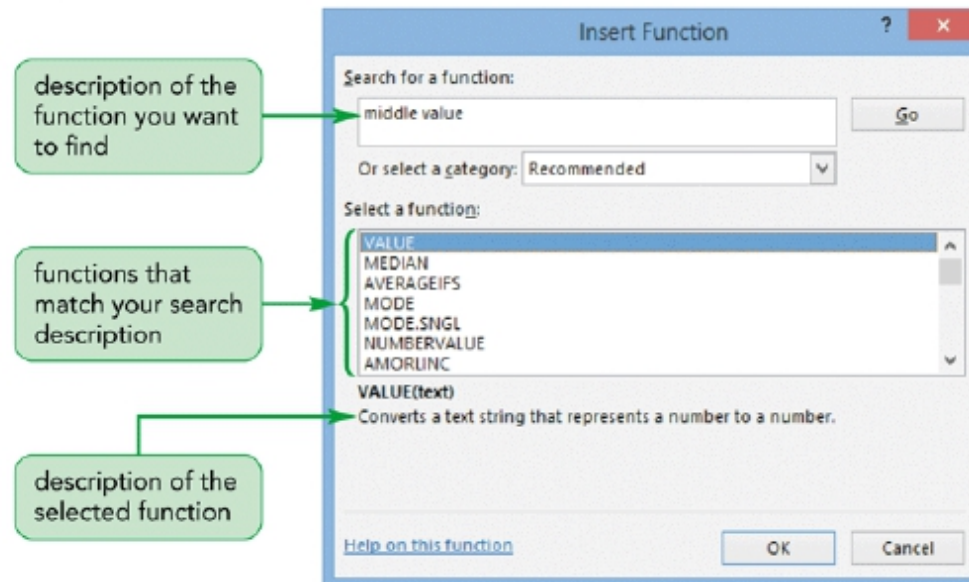
Inserting a Function

- Three possible methods:
 - Select a function from a function category in the Function Library
 - Open Insert Function dialog box to search for a particular function
 - Type function directly in cells

Using the Insert Function Dialog Box

- Organizes all functions by category
- Includes a search feature for locating functions that perform particular calculations

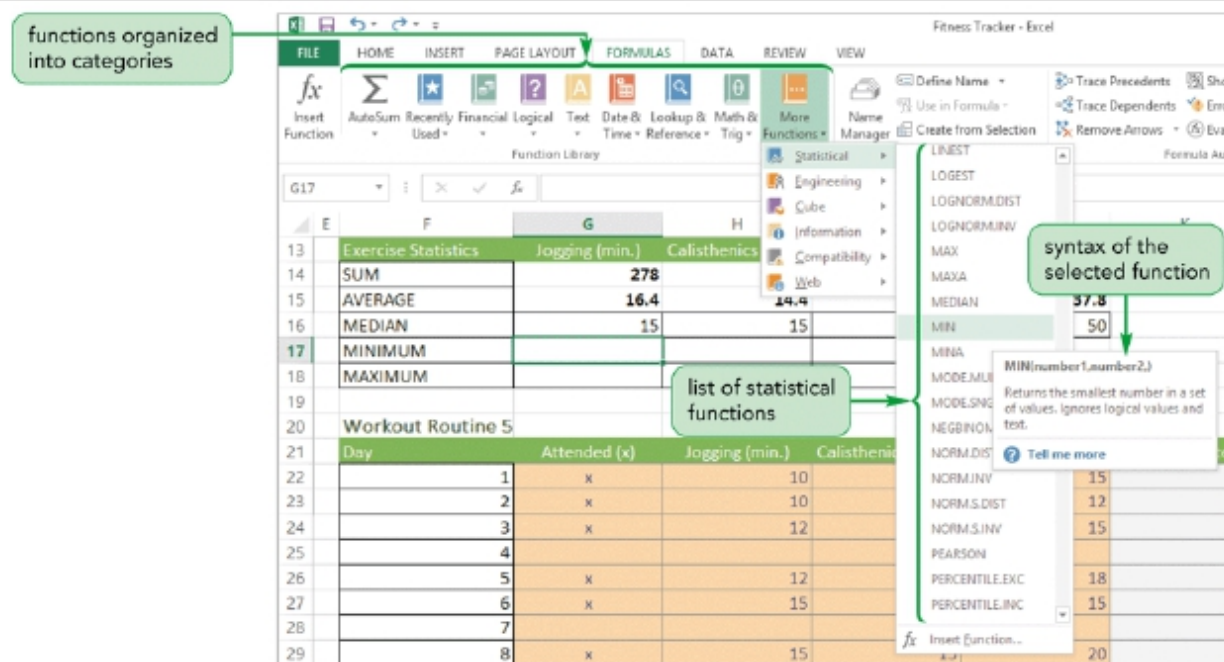
Figure 3-9 Insert Function dialog box



Using the Function Library to Insert a Function

- When you select a function, the Function Arguments dialog box opens, listing all arguments associated with that function

Figure 3-12 MIN function in the Function Library



Understanding Cell References

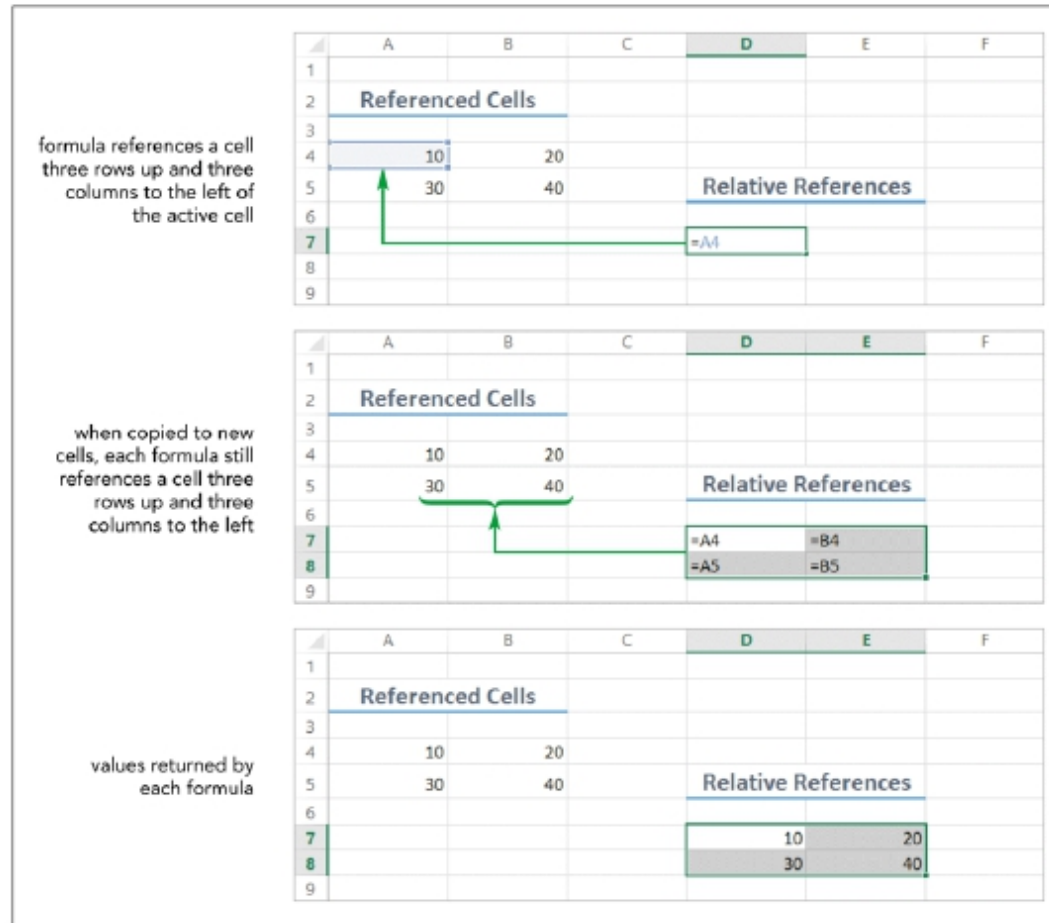
- To record and analyze data
 - Enter data in cells in a worksheet
 - Reference the cells with data in formulas that perform calculations on that data
- Types of cell references
 - Relative
 - Absolute
 - Mixed

Using Relative References

- Cell reference as it appears in worksheet (B2)
- Always interpreted in relation (relative) to the location of the cell containing the formula
- Changes when the formula is copied to another group of cells
- Allows quick generation of row/column totals without revising formulas

Formulas Using a Relative Reference

Figure 3-16 Formulas using relative references



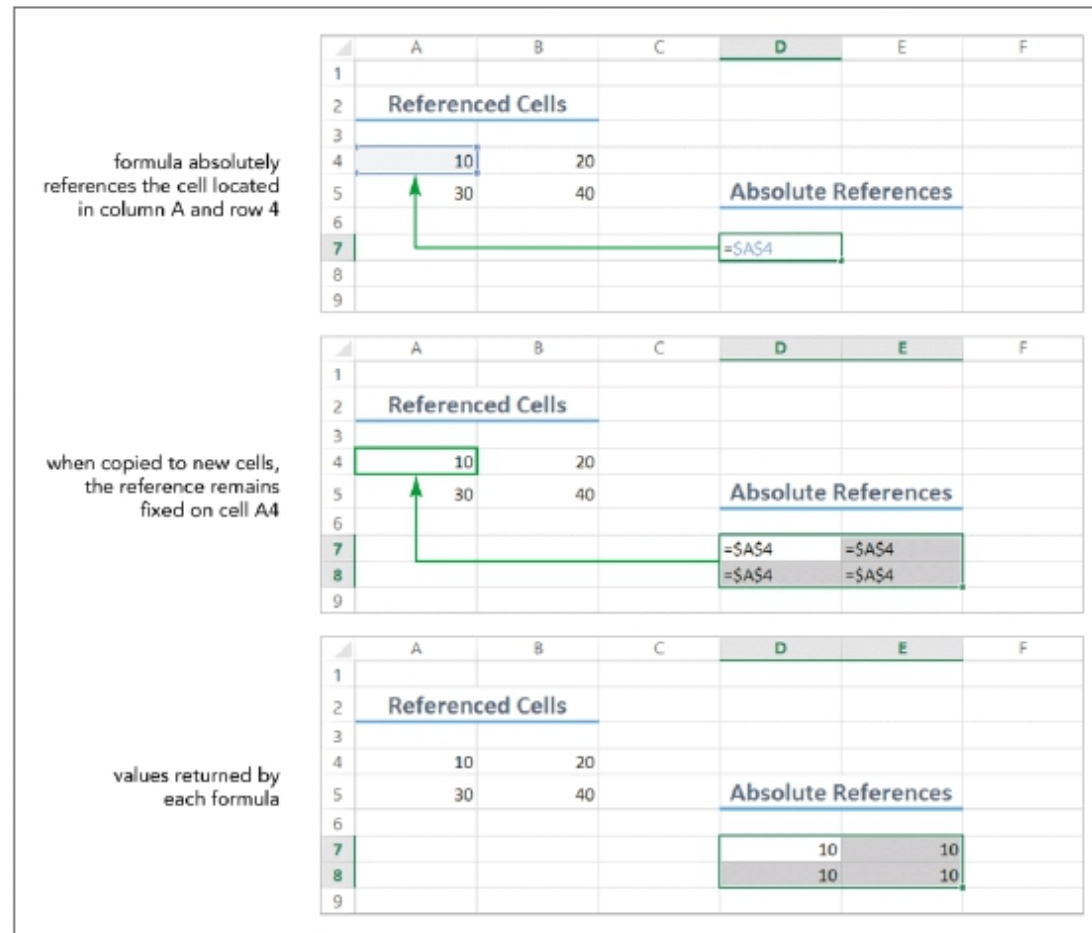
© 2014 Cengage Learning

Using Absolute References

- Cell reference that remains fixed when the formula is copied to a new location
 - Have a \$ before each column and row designation (\$B\$2)
 - Enter values in their own cells; reference the appropriate cells in formulas in the worksheet
 - Reduces amount of data entry
 - When a data valued is changed, all formulas based on that cell are updated to reflect the new value
-

Formulas Using an Absolute Reference

Figure 3-17 Formulas using absolute references



© 2014 Cengage Learning

Using Mixed References

- Contain both relative and absolute references
- “Lock” one part of the cell reference while the other part can change
- Have a \$ before either the row or column reference (\$B2 or B\$2)

Using a Mixed Reference

Figure 3-18 Formulas using mixed references

mixed cell reference that fixes the column reference for the first term and the row reference for the second term

	A	B	C	D	E	F	G
1		Multiplication Table					
2		1	2	3	4	5	
3	1	=A3*B\$2					
4	2						
5	3						
6	4						
7	5						
8							

when copied to the B3:B7 range, the fixed references remain unchanged and the relative references are shifted

	A	B	C	D	E	F	G
1		Multiplication Table					
2		1	2	3	4	5	
3	1	=A3*B\$2	=A3*C\$2	=A3*D\$2	=A3*E\$2	=A3*F\$2	
4	2	=A4*B\$2	=A4*C\$2	=A4*D\$2	=A4*E\$2	=A4*F\$2	
5	3	=A5*B\$2	=A5*C\$2	=A5*D\$2	=A5*E\$2	=A5*F\$2	
6	4	=A6*B\$2	=A6*C\$2	=A6*D\$2	=A6*E\$2	=A6*F\$2	
7	5	=A7*B\$2	=A7*C\$2	=A7*D\$2	=A7*E\$2	=A7*F\$2	
8							

values returned by each formula

	A	B	C	D	E	F	G
1		Multiplication Table					
2		1	2	3	4	5	
3	1	1	2	3	4	5	
4	2	2	4	6	8	10	
5	3	3	6	9	12	15	
6	4	4	8	12	16	20	
7	5	5	10	15	20	25	
8							

When to Use Relative, Absolute, and Mixed References

- Relative references
 - Repeat same formula with cells in different locations
- Absolute references
 - Different formulas to refer to the same cell
- Mixed references
 - Seldom used other than when creating tables of calculated values
- Use F4 key to cycle through different types of references

3.2 Look-up Tables

Basal Metabolic Rate Activity Factors

Activity Level	BMR Factor
Sedentary	1.200
Light	1.375
Moderate	1.550
High	1.725
Extreme	1.900

Personal Data

Name	Daniel Pridham
Activity Level	Light
Age (years)	45
Weight (lb.)	173
Height (in.)	70
Waist (in.)	37
Neck (in.)	15.5

Fitness Assessment

BMI	24.8
Resting BMR (cal./day)	1729
Active BMR (cal./day)	2377

Workout Summary

Start Date	8/1/2016
Ending Date	8/31/2016
Workouts Scheduled	23
Workouts Attended	17
Workouts Missed	6

Exercise Statistics

	Logging (min.)
SUM	278
AVERAGE	16.4
MEDIAN	15.0
MAXIMUM	22.0
MINIMUM	10.0

Workout Routine 5

Day	Attended (x)
8/1/2016	x
8/2/2016	x
8/3/2016	x
8/4/2016	
8/5/2016	x
8/6/2016	x
8/7/2016	
8/8/2016	x
8/9/2016	
8/10/2016	x
8/11/2016	x
8/12/2016	x

Notes

Formula: $=6.23 * C11 + 12.7 * C12 - 6.76 * C10 +$
 $=VLOOKUP(C9, O8:P12, 2, FALSE)$

Explanations:

- A lookup table stores the data you want to retrieve in categories. This is a vertical lookup table that organizes the categories in the first column of the table.
- Compare values are the categories located in the first column of the lookup table and are used for matching to a lookup value specified by the user.
- Return values are the data values you want to retrieve from the lookup table and are located in the second and subsequent columns.
- A lookup value is the category you want to find in a lookup table.
- The VLOOKUP function returns values from a vertical lookup table by specifying the lookup value to match to a compare value, the location of the lookup table, and the column in the table that contains the return values.

© 2014 Cengage Learning

Logical and Lookup Functions

The screenshot displays a spreadsheet titled "Fitness Tracker - Excel" with several data tables and callout boxes explaining specific functions.

Callout 1 (COUNT and COUNTA): Points to a cell containing the date "8/1/2016". The formulas shown are `=F44`, `=COUNT(F22:F44)`, `=COUNTA(G22:G44)`, and `=G9-G10`.

Callout 2 (COUNT function): The COUNT function tallies how many cells in the specified range contain numbers or dates.

Callout 3 (COUNTA function): The COUNTA function tallies how many cells in the specified range are not blank (contain numbers, dates, or text).

Callout 4 (IF function): A logical function is a function that works with statements that are either true or false. This logical function tests whether the value of cell G22 equals x. The IF function is a logical function that tests a condition and then returns one value if the condition is true and another value if the condition is false. The formulas shown are `=IF(G22="x",SUM(H22:J22),"")`, `=IF(G23="x",SUM(H23:J23),"")`, `=IF(G24="x",SUM(H24:J24),"")`, and `=IF(G25="x",SUM(H25:J25),"")`.

Callout 5 (WORKDAY function): The WORKDAY function displays the date of a weekday that is a specified number of weekdays past a starting date. The formulas shown are `=G7`, `=WORKDAY(F22,1)`, `=WORKDAY(F23,1)`, and `=WORKDAY(F24,1)`.

Data Tables:

8/1/2016	8/31/2016	23	17	6
Jogging (min.)	Calisthenics			
278				
16.4				
15.0				
22.0				
10.0				

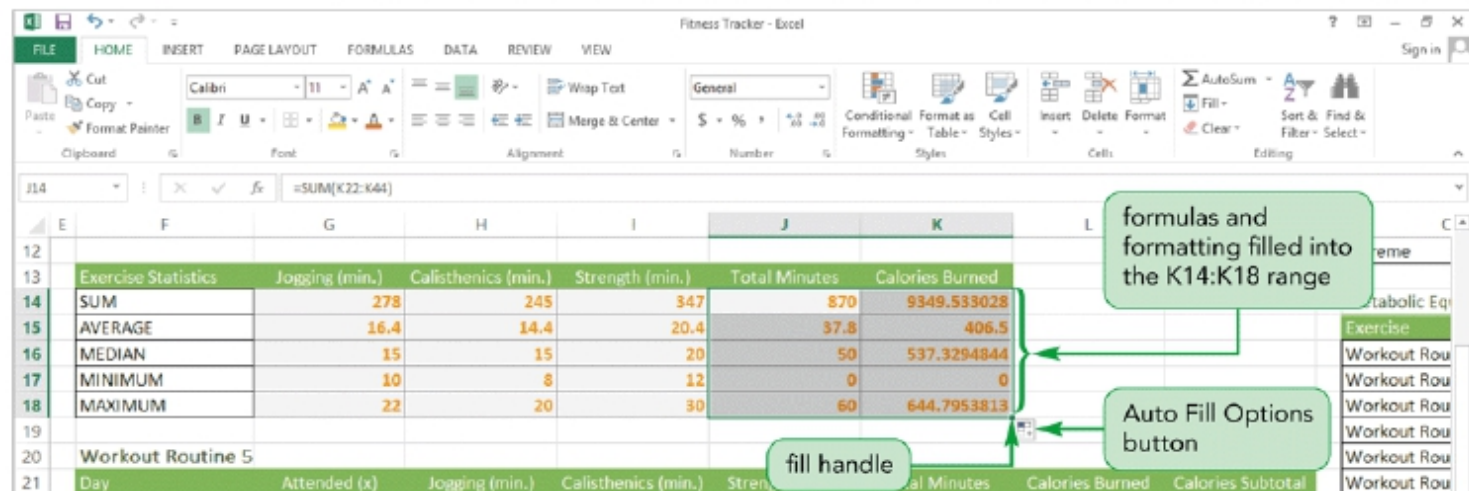
Attended (x)	Jogging (min.)	Calisthenics	Swimming (min.)	Total Minutes
5 x	10	15		35
6 x	8	12		30
4 x	15	15		45
5 x	18	15		45
6 x	15	15		40
6 x	15	20		50
6 x	13	22		50
6 x	20	15	25	60

Entering Data and Formulas with AutoFill

- Use the fill handle to copy a formula and conditional formatting
 - More efficient than two-step process of copying and pasting
- By default, AutoFill copies both content and formatting of original range to selected range

Entering Data and Formulas with AutoFill

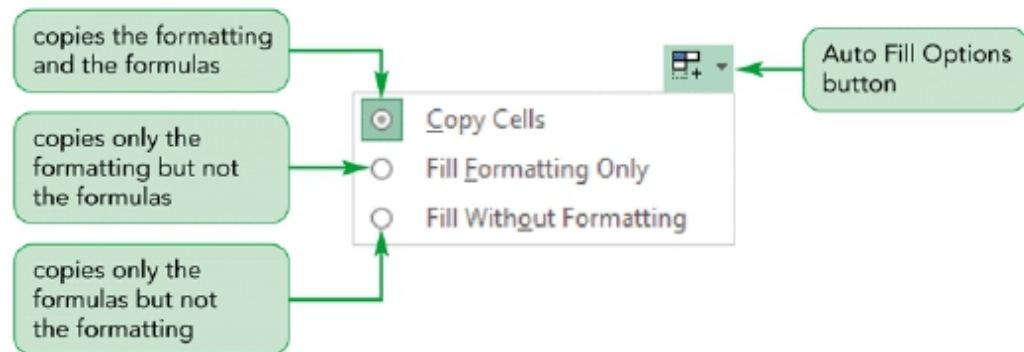
Figure 3-21 Formulas and formatting copied with AutoFill



Entering Data and Formulas with AutoFill

- Use Auto Fill Options button to specify what is copied

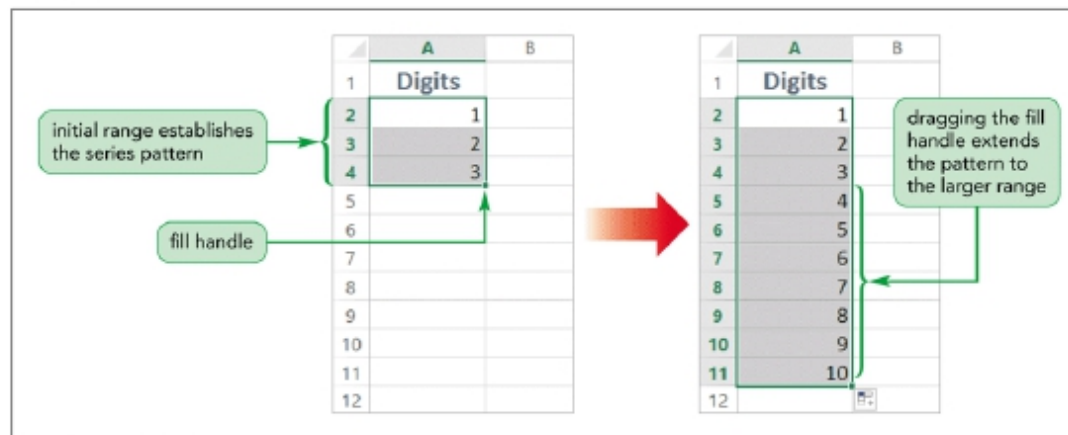
Figure 3-22 Auto Fill Options button



Entering Data and Formulas with AutoFill

- Use AutoFill to create a series of numbers, dates, or text based on a pattern

Figure 3-23 AutoFill extends a numeric sequence



© 2014 Cengage Learning

- Use Series dialog box for more complex patterns

Entering Data and Formulas with AutoFill

Figure 3-24 AutoFill extends numbers, dates and times, and patterned text

Type	Initial Pattern	Extended Series
Numbers	1, 2, 3	4, 5, 6, ...
	2, 4, 6	8, 10, 12, ...
Dates and Times	Jan	Feb, Mar, Apr, ...
	January	February, March, April, ...
	15-Jan, 15-Feb	15-Mar, 15-Apr, 15-May, ...
	12/30/2016	12/31/2016, 1/1/2017, 1/2/2017, ...
	12/31/2016, 1/31/2017	2/29/2017, 3/31/2017, 4/30/2017, ...
	Mon	Tue, Wed, Thu, ...
	Monday	Tuesday, Wednesday, Thursday, ...
Patterned Text	11:00AM	12:00PM, 1:00PM, 2:00PM, ...
	1st period	2nd period, 3rd period, 4th period, ...
	Region 1	Region 2, Region 3, Region 4, ...
	Quarter 3	Quarter 4, Quarter 1, Quarter 2, ...
	Qtr3	Qtr4, Qtr1, Qtr2, ...

© 2014 Cengage Learning

Working with Date Functions

- For scheduling or determining on what days of the week certain dates occur

Figure 3-27 Date functions

Function	Description
DATE(<i>year, month, day</i>)	Creates a date value for the date represented by the <i>year, month, and day</i> arguments
DAY(<i>date</i>)	Extracts the day of the month from <i>date</i>
MONTH(<i>date</i>)	Extracts the month number from <i>date</i> where 1=January, 2=February, and so forth
YEAR(<i>date</i>)	Extracts the year number from <i>date</i>
NETWORKDAYS(<i>start, end[, holidays]</i>)	Calculates the number of whole working days between <i>start</i> and <i>end</i> ; to exclude holidays, add the optional <i>holidays</i> argument containing a list of holiday dates to skip
WEEKDAY(<i>date[, return_type]</i>)	Calculates the weekday from <i>date</i> , where 1=Sunday, 2=Monday, and so forth; to choose a different numbering scheme, set <i>return_type</i> to 1 (1=Sunday, 2=Monday, ...), 2 (1=Monday, 2=Tuesday, ...), or 3 (0=Monday, 1=Tuesday, ...)
WORKDAY(<i>start, days[, holidays]</i>)	Returns the workday after <i>days</i> workdays have passed since the <i>start</i> date; to exclude holidays, add the optional <i>holidays</i> argument containing a list of holiday dates to skip
NOW()	Returns the current date and time
TODAY()	Returns the current date

© 2014 Cengage Learning

Displaying the Current Date with the **TODAY** function

- Many workbooks include the current date. You can use the **TODAY function** to display the current date in a worksheet.

Displaying the Current Date with the TODAY function

- Inserting the Today function
 - Select the cell you wish the date to appear in.
 - On the Formulas tab, in the Function Library group, click the Date & Time button to display the date and time functions.
 - Click TODAY. The Function Arguments dialog box opens and indicates that the TODAY function requires no arguments.
 - Click the OK button. The formula =TODAY() is entered in the selected cell.

Counting Cells

- Excel has two functions for counting cells—the COUNT function and the COUNTA function.
- The COUNT function tallies how many cells in a range contain numbers or dates (because they are stored as numeric values).
 - The COUNT function does not count blank cells or cells that contain text.

Counting Cells

COUNTA FUNCTION

- If you want to know how many cells contain entries—whether those entries are numbers, dates, or text—you use the COUNTA function, which tallies the nonblank cells in a range.
 - The COUNTA function does not count blank cells

Working with Logical Functions

- Logical functions
 - Build decision-making capability into a formula
 - Work with statements that are either true or false
- Excel supports many different logical functions, including the IF function

Comparison Operators

Figure 3-31 Comparison operators

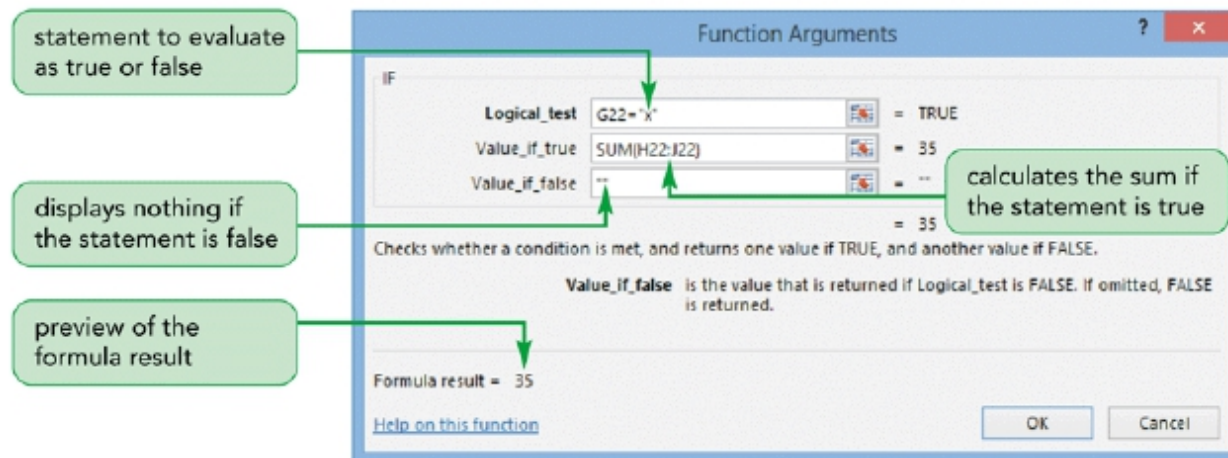
Operator	Expression	Description
=	A1 = B1	Tests whether the value in cell A1 is equal to the value in cell B1
>	A1 > B1	Tests whether the value in cell A1 is greater than the value in cell B1
<	A1 < B1	Tests whether the value in cell A1 is less than the value in cell B1
>=	A1 >= B1	Tests whether the value in cell A1 is greater than or equal to the value in cell B1
<=	A1 <= B1	Tests whether the value in cell A1 is less than or equal to the value in cell B1
<>	A1 <> B1	Tests whether the value in cell A1 is not equal to the value in cell B1

© 2014 Cengage Learning

Using the IF Function

- Returns one value if a statement is true and returns a different value if that statement is false
- **IF** (*logical_test*, [*value_if_true*,] [*value_if_false*])

Figure 3-32 Function Arguments dialog box for the IF function



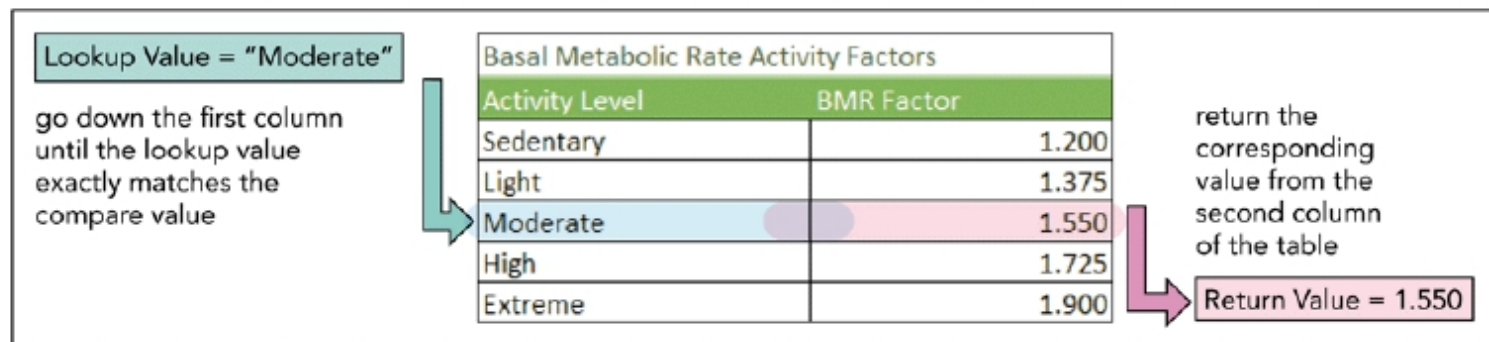
Using a Lookup Function

- **Lookup functions** find values in tables of data and insert them in another location in the worksheet such as cells or in formulas.
 - Often you need the contents of a table to change relative to a set of criteria that may change over a period of time. A look up table searches for data in one place then uses that data to populate information in another place.
 - For example, a students numeric grade (percentage) may change throughout the semester and the corresponding changes must also be applied to the letter grade (A, B, C...).

Lookup tables

- The table that stores the data you want to retrieve is called a lookup table. A lookup table organizes numbers or text into categories.

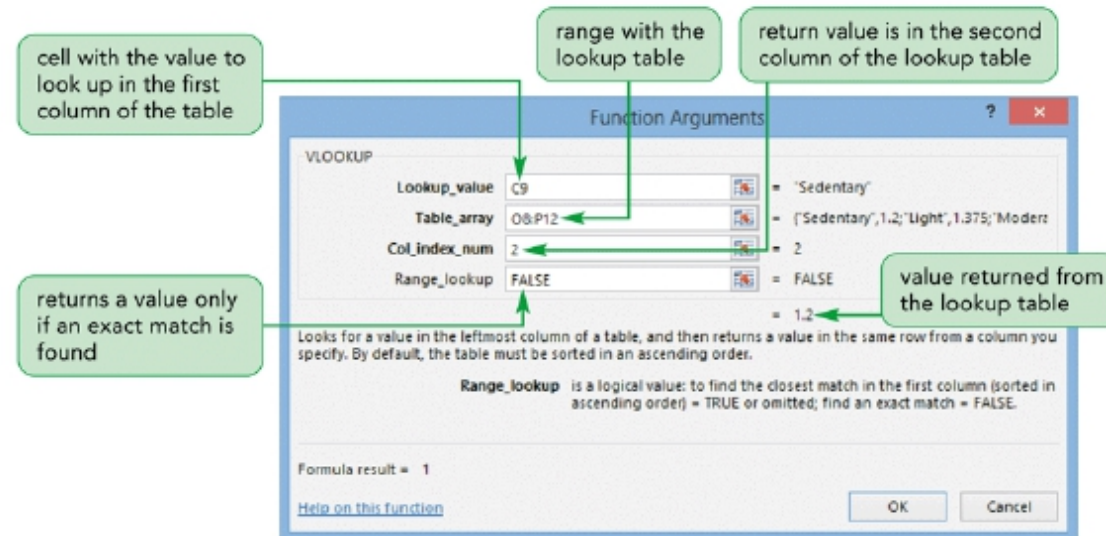
Figure 3-35 Finding an exact match from a vertical lookup table



© 2014 Cengage Learning

Function Arguments dialog box for the VLOOKUP function

Figure 3-36 Function Arguments dialog box for the VLOOKUP function



Performing What-If Analysis

- A **what-if analysis** lets you explore the impact that changing input values has on the calculated values in the workbook.
- Examples of a what-if analysis occur when calculating car loans or mortgages.
 - What will my loan payment be if the interest rate is 6% and also at 7%?
 - What will the loan balance be if I put \$10,000 down or if I put \$20,000 down?

Trial and Error

- One way to perform a what-if analysis is by changing one or more of the input values to see how they affect the calculated results.
- This **trial-and-error method** requires some guesswork as you estimate which values to change and by how much.

Using Goal Seek

- **Goal Seek** automates the trial-and-error process by allowing you to specify a value for a calculated item, which Excel uses to determine the input value needed to reach that goal.
- In some ways this is the opposite of trial and error as goal seek allows us to input the answer and then calculates the associated variables to arrive at the answer.

Goal Seek Dialog Box

Figure 3-38 Goal Seek dialog box

